



August 1, 2011

LCDR Joseph Cohn  
Program Officer, Code 341  
Office of Naval Research  
875 North Randolph Street  
Arlington, VA 22203-1995  
[joseph.cohn@navy.mil](mailto:joseph.cohn@navy.mil)

RE: Contract N00014-10-C-0363  
Progress Report

Dear LCDR Cohn,

Attached please find our Quarterly Progress report for Contract N00014-10-C-0363 for the Integrated Warfighter Biodefense Program (IWBP )- Code 34.  
Covering the period ending June 30, 2011.

Thank you for your assistance during this period of performance on the above noted program. Copies have been distributed as per the Contract Data Requirements List – Instructions for Distribution.

Sincerely,

A handwritten signature in black ink, appearing to read 'Frank T. Abbott', is written over a light gray rectangular background.

Frank T. Abbott  
VP of Administration & Finance  
[fta@quantumleap.us](mailto:fta@quantumleap.us)

cc: Dr. Ganesh Vaidyanathan, Project Manager, Code 34, QLI [gv@quantumleap.us](mailto:gv@quantumleap.us)  
Dr. Dawn Defenbaugh, Program Management, [dd@quantumleap.us](mailto:dd@quantumleap.us)  
Administrative Contracting Officer – Stanley Brown, [stanley.brown@dcma.mil](mailto:stanley.brown@dcma.mil)  
Director, Naval Research Lab, Attn Code 5596, [reports@library.nrl.navy.mil](mailto:reports@library.nrl.navy.mil)  
Defense Technical Information Center, [tr@dtic.mil](mailto:tr@dtic.mil)  
Ms. Lauren Gates, ONR, [Lauren.Gates.Ctr@Navy.mil](mailto:Lauren.Gates.Ctr@Navy.mil)

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## **Progress Report**

### **Integrated Warfighter Biodefense Program (IWBP)**

**Submitted By:** Quantum Leap Innovations, Inc.

3 Innovation Way, Suite 100

Newark, DE 19711-5456

**Contract Number:** N00014-10-C-0363

**Report Date:** August 1, 2011

**Reporting Period:** April 1, 2011 – June 30, 2011

**Principal Investigator:** Dr. Ganesh Vaidyanathan

Phone: (302) 894-8044

Fax: (302) 894-8001

[gv@quantumleapinnovations.com](mailto:gv@quantumleapinnovations.com)

**Monitoring DoD Organization:** LCDR Joseph Cohn

Program Officer, Code 341

Office of Naval Research

875 North Randolph Street

Arlington, VA 22203-1995

[joseph.cohn@navy.mil](mailto:joseph.cohn@navy.mil)

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3 Innovation Way  
Suite 100  
Newark, DE 19711

phone 302.894.8000  
fax 302.894.8001

[www.quantumleapinnovations.com](http://www.quantumleapinnovations.com)

## **EXECUTIVE SUMMARY:**

This report outlines Quantum Leap Innovations, Inc. (QLI) accomplishments during the three months of performance between April 1, 2011 and June 30, 2011 on ONR Contract N00014-10-C-0363 for the Integrated Warfighter Biodefense Program (IWBP). The report summarizes activities focused on continued development of the LeapWork® Pattern Based Analytics (PBA) Platform.

## **SUMMARY OF ACCOMPLISHMENTS:**

### **Targetless Pattern Based Discovery:**

In the previous quarterly report, several technology developments associated with Pattern Based Analytics were summarized. The focus of these efforts was the case where a target feature has been defined. Patterns that are informative against this target can be automatically discovered using extensions to Shannon mutual information.

There are many situations where a priori definition of a target may be difficult. For example, in a sensor environment, lots of data can be collected and it would be valuable to discover informative data associations amongst a subset of the features without a specific target in mind. Data associations even in the absence of a specific target can often provide insights into behavior and subsequent unfolding of events. For example, correlations within a group of features in a data environment can allow an analyst to infer the state of one of the features if other feature states within the group match the pattern. This inference could then provide the basis for a proactive action.

To illustrate the above point, consider the following pattern: Whenever it is sunny and it is a Friday, the road to a hillside station has high traffic volume. If this pattern is true 90% of the time, and it is a sunny Friday, with high confidence we can plan around there being high traffic volume on that road, even if we do not have explicit knowledge regarding traffic conditions. The analogy could be extended to many other types of “micro-associations” that could provide strategic planners and decision makers with powerful planning capabilities to provide dynamic situational awareness.

During the current reporting period, the mathematical foundation for target less pattern discovery was established. The mathematics is based on information theory with appropriate modifications to account for the lack of an explicit target feature and to establish a well behaved and normalized measure. This effort required significant literature review and analysis to determine the best way to integrate the method into the existing LeapWorks platform. The mathematical algorithm has been implemented and is currently being tested and evaluated on a number of real world data sets.

### **Enhancements to LeapWorks Pattern Based Discovery work flow:**

During the current reporting period, significant enhancements have been made to the LeapWorks Pattern Based Discovery work flow to facilitate exploratory data analysis and visualization. The primary objective has been to allow the end user to easily identify patterns of most interest to them as the basis for further data exploration, visualization and analysis.

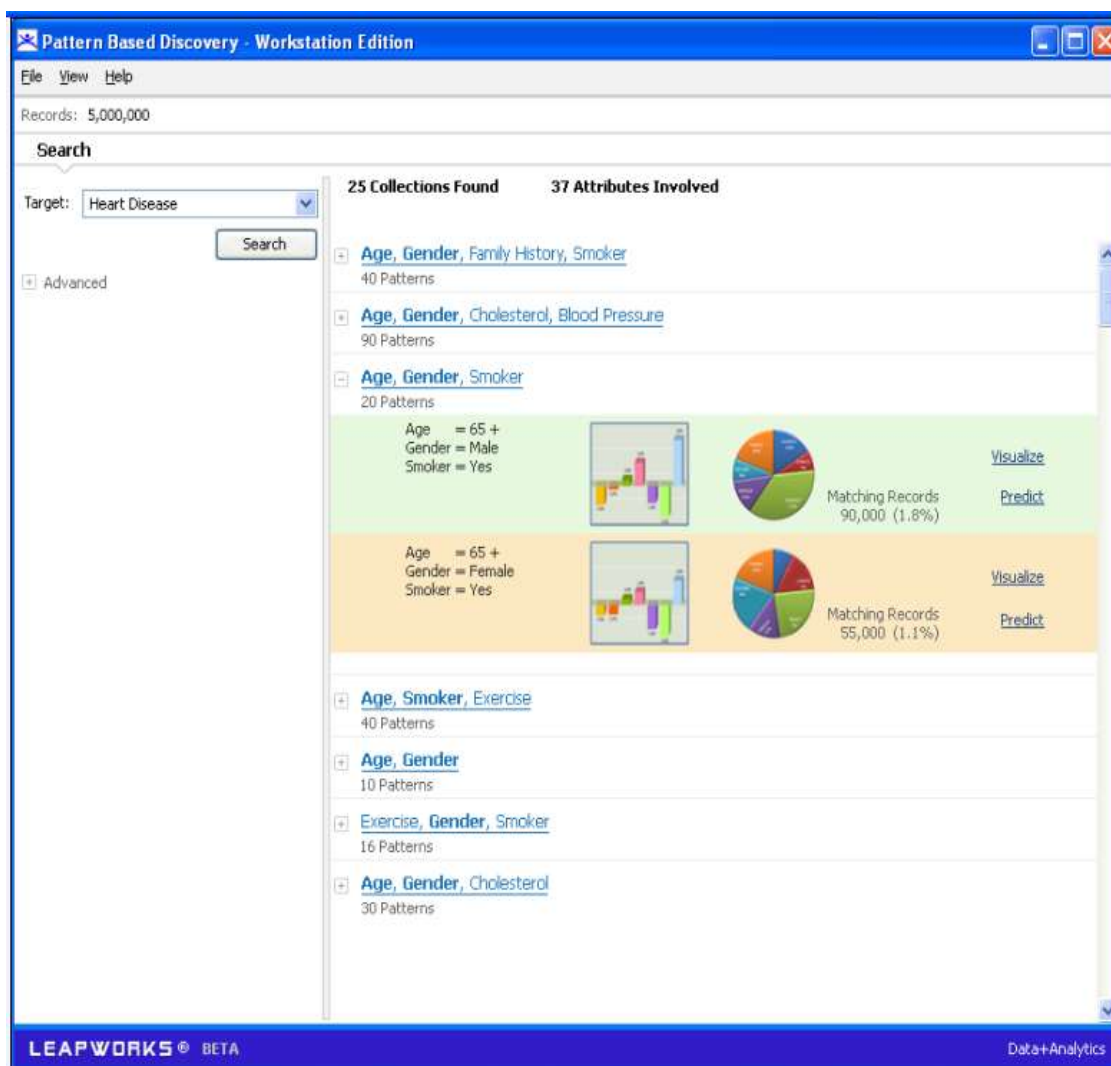


Figure1. New Search based Discovery Work Flow

Figure 1 shows a mockup of the new search inspired work flow. In the query box in the top left, the target feature “Heart Disease” is shown. The results of the search are shown in the list on the right. Several patterns, automatically discovered from the underlying data, are shown in the results list. In the middle of the screen, specific patterns associated with the feature collection “Age”, “Gender”, and “Smoker” are expanded to provide a visual summary of the statistics associated with the corresponding pattern. Action links on the right include “Visualize” and “Predict” in this early mockup. As the platform develops, additional actions can be included.

The key innovation in this approach, that of marrying search engine methodology with information theory based discovery, has been protected through filing a provisional patent application. The motivation is to provide users with new insights into their data using a “Google like” work flow that is intuitive for non-statisticians. Each discovered pattern can also be viewed as a reference or link to an associated data subset within the larger data environment against which subsequent exploration, visualization and analysis can be performed.

During the current reporting period, significant work has been expended to implement the design that has been summarized above. The initial domain focus for this work has been

in health care, consistent with the broader goals of IWBP. Areas of potential application include health care administration, clinical data analysis and health care research applications.

#### **Customer Engagements:**

During the current reporting period, significant effort was also expended in identifying potential partners and customers for the LeapWorks Pattern Based Analytics Platform. Quantum Leap attended the Blueprint Health Care Innovation Summit in Philadelphia on May 26, 2011 as one of the 10 finalists for innovative vendors. Quantum Leap was selected by St. Barnabas Health Care System and Visiting Nurse Service of New York as a top vendor in innovative health care solutions. In addition, there have been several ongoing discussions with other health care centers including NYU Medical Center and Christiana Care on health care related applications of the LeapWorks Pattern Based Analytics platform.

#### **NEXT STEPS:**

During the next reporting period, the mathematical algorithm for target less discovery will be tested on several data sets to validate the methodology. In addition, significant effort will continue to be expended on working with customers to expedite customer acceptance of the LeapWorks Pattern Based Analytics platform.

In terms of work flow development, during the next reporting period, the core Search based Discovery product will be completed and ready for testing. In addition, work will start on integrating more advanced analysis options such as Pattern Based Prediction into this new workflow.

#### **FINANCIAL SUMMARY:**

##### **Contract Activity**

QLI Contract N00014-10-C-0363	\$2,987,891
Award date: 07/01/2010	

ACTUAL: Expenditures Invoiced to the Government through June 30, 2011	\$ 1,117,222
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37% of Contract Value has been spent as of June 30, 2011